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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/187,551 11/05/98 MUSAKA

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EXAMINER

PADGETT, M

ART UNIT

PAPER NUMBER

1762 4

DATE MAILED: 07/16/99

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

## Office Action Summary

Application No.	09/187,531	Applicant(s)	Musaka et al
Examiner	M. L. Padgett	Group Art Unit	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

### Period for Response

A SHORTENED STATUTORY PERIOD FOR RESPONSE IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a response be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for response is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to respond within the set or extended period for response will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

### Status

Responsive to communication(s) filed on 3/5/99.

This action is FINAL.

Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

### Disposition of Claims

Claim(s) 1-26 is/are pending in the application.

Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

Claim(s) \_\_\_\_\_ is/are allowed.

Claim(s) 1-26 is/are rejected.

Claim(s) \_\_\_\_\_ is/are objected to.

Claim(s) \_\_\_\_\_ are subject to restriction or election requirement.

### Application Papers

See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

The proposed drawing correction, filed on \_\_\_\_\_ is  approved  disapproved.

The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.

The specification is objected to by the Examiner.

The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. § 119 (a)-(d)

Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

All  Some\*  None of the CERTIFIED copies of the priority documents have been received.

received in Application No. (Series Code/Serial Number) \_\_\_\_\_.

received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_.

### Attachment(s)

Information Disclosure Statement(s), PTO-1449, Paper No(s). 2  Interview Summary, PTO-413

Notice of References Cited, PTO-892  Notice of Informal Patent Application, PTO-152

Notice of Draftsperson's Patent Drawing Review, PTO-948  Other \_\_\_\_\_

## Office Action Summary

Art Unit: 1762

(1) Claims 11-26 are rejected under 35 U.S.C. 251 as being an improper recapture of claimed subject matter deliberately canceled in the application for the patent upon which the present reissue is based. As stated in *Ball Corp. v. United States*, 221 USPQ 289, 295 (Fed. Cir. 1984):

The recapture rule bars the patentee from acquiring, through reissue, claims that are of the same or broader scope than those claims that were canceled from the original application.

In order to make the claims allowable over the prior art in parent application 08/259,584, the specific halogen F, as well as the specific type of fluorine source, CX<sub>4</sub> or CX<sub>3</sub> -(CX<sub>2</sub>)<sub>n</sub>-CX<sub>3</sub>, were added to the claims, as well as the minimum concentration of F in the deposited silicon oxide. The new claims broaden the scope of the claims to include all types of halogens from any source and do not require a minimum [F]. Furthermore, while the new claims, as exemplified by claims 11, relate the deposition of some unspecified layer deposited from gases comprising Si, O and halogen to "a predetermined intrinsic stress level", this stress level and the concentration of fluorine are inherently related, as can be seen in applicant's graphs (Figs. 9-13) or in Homma (EPO 517,548 or USPN 5,288,578) in col. 4 of the EPO references, hence removing the concentration and source limitations is recapture. For a further example of recapture, note dielectric constant is also related to [F], and according to Fig., 11, applicant's claim of a valve up to 4.1 includes atomic % F lower than the claim 1 minimum. See *Hester Industries Inc. vs Stein Inc.*, 46 USPQ 2d 1641, and *In re Clement*, 45 USPQ 2d 1161.

Art Unit: 1762

As there was no process claim allowed in P.N. 5,571,571 that corresponds to the apparatus claims 24-26, the addition of these apparatus claims with their functional description of material stored in a computer, is NOT consistent with the acceptable broadening of scope described in the MPEP at the end of section 1412.02.

(2) Claims 11-26 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The added claims are replete with new matter. Specifically in claim 11, the claim of generic layer deposition, "a predetermined intrinsic stress level" and "a process gas comprising silicon, oxygen and said halogen source" are not supported by the original specification. In the patent and specification, note that all depositions are taught to deposit silicon oxide layers and that all inventive processes use TEOS for the Si source, with no generic teachings or use of other gases. In the matter of "intrinsic stress", the only mention of this term is found in the background (col. 3, line 35) when discussing prior art. When discussing the inventive process, all terms involving stress either have no modifier (Figure 13; col. 4, lines 46-49; and col. 9, lines 28-30) or are "compressive" (col. 6, lines 43-45; col. 8 lines 23-25 and 66- col. 9, line 6). For these reasons, all claims to "intrinsic stress", ( nonsilicon oxide) generic layer deposition and Si source material other than TEOS, as well as limitation relating thereto, are New Matter.

Art Unit: 1762

In claim 14, no disclosure of using SiF<sub>4</sub> or TEFS as a fluorine sources was found in the original specification. See col. 4, line 69-col. 5, line 3 for variety of sources actually taught.

In claim 18, claims repeatedly performing measuring and adjusting of intrinsic stress on a plurality of halogen doped silicon oxide film coated substrates, but no where in applicant's specification is there any teaching of measuring and adjusting in a real time situation, nor coating of a sequence of substrates under circumstances claimed. The closest disclosures to these claims are Fig. 1A-F, 2 A-F (prior art), and 4A-F plus 7A-F (instant process), which compare the effects of single layer silicon oxide from silane (1) or TEOS (2) via conventional PECVD without halogens (prior art), or TEOS, He, C<sub>2</sub>F<sub>6</sub> and O<sub>2</sub> using duel or single frequency parallel plate plasma deposition (instant process) on substrates having a variety of width and spacings of Al stripes, hence supports neither measurement of intrinsic stress in a manufacturing sequence, nor the claimed sequential processing. Therefore, claim 18 contains NEW MATTER. Likewise, no disclosure of a database of measured intrinsic stress levels (claim 19), nor "high-density plasma chemical vapor deposition" and use of an RF coil (claim 20) were found to be supported, hence are also new matter. Note apparatus of Figures 3 and 6 are for parallel plate RF reactors, while Figure 5 is a microwave remote plasma, with an RF biased substrate, none of which use the claimed RF coil or are discussed as high density.

Similarly, claims 21-23 contain New Matter, because they require multiple halogenated layer depositions on a single substrate, but the original specification NEVER deposits more than a single halogenated silicon oxide layer on a single substrate and contains NO teachings of

Art Unit: 1762

varying the halogen content between two layers portions or sublayers) on a single deposition site. No discussion of “tensile” stress levels was found in the original specification, relating to either the disclosed invention or the prior art, hence claims 22-23 contain additional New Matter. Furthermore, the deposition of the second portion of the layer further lacks support as it is inclusive of types of deposition not taught in the original specification, such as CVD reactions other than plasma depositions.

Apparatus claims 24-26 contain addition new matter (besides those limitations discussed above), in that neither the apparatus disclosed in Fig. 3, 5 or 6 nor the process steps disclosed provide support for the new claim limitations of “a controller...” (claim 24, line 8); “a memory coupled to ...” (line 10), “a computer readable medium having ... program” (lines 10-11); the “first set of instructions...” (lines 14-16) nor the “second set of instructions...” (lines 17-19). Claim 26 contains additional new matter, in that the claimed range of “a rate that is about 20% or less of the total gas flow...” is not taught in the specification, indeed besides the examples not being commensurate in scope as they disclose mere specific reaction materials. Col. 4, line 65 teaches 1:1 TEOS to halogen proportions, while the specific example of col. 6, lines 19-23 (TEOS +He at 480 Sccm; C<sub>2</sub>F<sub>6</sub> at 400 Sccm; and O<sub>2</sub> at 700 Sccm) provides a ratio of 400/1500 or 25.3% which is greater not less, hence is actually contradictory of the newly added claim, hence such a range was clearly not contemplated by the original specification.

Art Unit: 1762

Claims 11-26 are rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought. The added material which is not supported by the prior patent is as follows: is as discussed above.

(3) The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(f) he did not himself invent the subject matter sought to be patented.

Claims 11-20 and 24-26 are rejected under 35 U.S.C. 102(f) because the applicant did not invent the claimed subject matter. As discussed above these claims contain New Matter not disclosed in the original specification, hence no evidence is available to the examiner that the inventors K. Musaka and S. Mizuno are the originators of the limitations added by this reissue application. However, SN 08/691,983 to the same assignee (Applied Materials, Inc), but to an entirely different inventive entity, Nowak et al (ie no overlapping inventors), contains identically or almost identically worded claims, as well as like problems in the labeling of their stress vs. flow graph (to be discussed below), indicating some kind of interaction between the two inventor groups. Note that in 08/691,983 claims 2-9 are identical to claims 12-19, respectively, added in this reissue, while claims 11, 10, 18 and 20-24 are only different from claims 11, 20 and 24-26 by minor deletions or changes in wording, that do not appreciably change the content of the claims, hence there is prima facie evidence that the inventors in the 5,571,571 patent (this

Art Unit: 1762

reissue), did not invent the subject matter embodied by the New Matter introduced in this reissue application.

(4) The disclosure is objected to because of the following informalities: Applicant's graph in Fig. 13 and discussion thereof (as well as Fig. 3 to SN08/691,983 in Novak et al) have negative stress values that appear to be scientifically incorrect. If applicant's have an explanation for this, please supply a prior art reference, otherwise it appears that the values shouldn't be negative, but just down an order of magnitude, otherwise the scales don't make sense, because  $0 \times 10^9 = 0$ , giving a discontinuity not properly illustrated by the graph, ie an incredibly broad jump from  $0.5 \times 10^9$  to  $-0.5 \times 10^9$ . So are values really going from  $+0.5 \times 10^9$  dyne/cm<sup>2</sup> to  $-1.25 \times 10^9$  dyne/cm<sup>2</sup> (Musaka et al. Fig. 13) or is this an artifact from somebody's attempt to simplify the numbering on the axis? In the other application that appears to have provided the original claim language as discussed above in section 3, the specification, Figures 3 and 4 appear equally erroneous, having positive and negative values all to the power of  $10^9$  and in dyne/cm<sup>2</sup>. The examiner suspects that values that would make more sense are 0 is 0.1, .5 is 0.05, 1.0 is .01, etc., but sees NO enablement for this in the specification. The examiner also wonders if Fig. 9 is accurately labeled (hence is claim 9 correct? ), because saying that decreasing the ratio of F in the reactants increases the atomic  $\frac{F}{\text{Si}}$  deposited is scientifically questionable.

~~The information disclosure and art of the parent and related cases are made of record and a copy of the PTO-1449 is enclosed. Commonly seen values for internal stress for F-containing SiO<sub>2</sub> deposits, from plasma and other CVD depositions are noted with  $2 \times 10^8$  dyn/cm<sup>2</sup> to -1.25~~

Art Unit: 1762

~~$\times 10^9$  dyne/cm<sup>2</sup> (Musaka et al, Fig. 13) or is this an artifact from somebodies attempt to simplify the numbering on the axis? In the other application that appears to have provided the original claim language as discussed above in section 3, the specification, Figures 3 and 4 appear equally erroneous, having positive and negative values all to the power of 10<sup>9</sup> and in dyne/cm<sup>2</sup>. The examiner suspects that values that would make more sense are 0 is 0.1, .5 is 0.05, 1.0 is .01, etc. but sees NO enablement for this in the specification. The examiner also wonders if Fig. 9 is accurately labeled (hence is claim 9 correct?), because saying that decreasing the ratio of F in the reactants is scientifically suspicious.~~

(5) The information disclosure and ~~art~~ of the parent and related cases are made of record and a copy of the PTO-1449 is enclosed. Commonly seen values for internal stress for F-containing SiO<sub>2</sub> deposits, from plasma and other CVD depositions are noted with 2x10<sup>8</sup> dyn/cm<sup>2</sup> (See Homma's 5,288,518; col. 3, lines 42-45) being exemplary, and probably related in some fashion to what applicant's values should have been.

(6) Claims 11-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In the claims, as read in light of the specification, the examiner is unclear on the differences in meaning supplied and intended by "intrinsic stress", "compressive stress" and "tensile stress", especially as only the middle term is related to the description of the inventive process in the body of the original specification, the last term is never discussed and claim 12

Art Unit: 1762

seems to be implying that compressive is either the same thing or a subset of intrinsic claims 21-23, imply both compressive and tensile stress are the same or a subset of intrinsic stress. Prior art definitions of the meanings of these terms would be appropriate, as well as how they relate to the term "internal stress" also seen in the prior art. As the terms internal and intrinsic appear to be directed to the same kind of meaning they will be assumed to be equivalent unless shown otherwise. The word "tensile" means capable of tension: Ductile; of, relating to, or involving tension, while "tensile strength" is "the greatest longitudinal stress a substance can bear without tearing apart", hence linguistically compressive (pushing together) and tensile (pulling apart) would appear to be related as opposing descriptions of how the stress is working on the layer, ie opposite ends on a continuum of forces, but clear definition of the scientific meaning with respect to the original specification is needed.

In claim 14 the abbreviation TEFS needs to be defined, especially as it is nowhere to be found in the original specification.

Due to the confusion discussed above in section 4 involving the stress values given in the graph of Figure 13, it is unclear what validity the stress levels in claims 16 and 25 have. Also not the value of "-1.0" in claim 25 is ambiguous as to whether it is associated with the  $10^9$  or not. In claim 18, line 2 "steps (a) through (c)" would appear to be referring back to (a), (b) and (c) in claim 11, but they have never been referred to as steps, hence the nomenclature is inconsistent or unclear, but would be corrected by inserting --steps of-- after "comprising" in line 2 of claim 11 and --the-- before "steps(a)" of claim 18.

Art Unit: 1762

In claim 18 “a halogen-doped silicon oxide film” is never clearly related to the “layer” of the independent claim 11, and is introduced 3 times, ie in lines 2-3; line 8 and lines 12-3, creating antecedent basis problems, with no clear differentiation.

Use of relative terms is considered vague and indefinite unless a definition is provided in the original specification or by prior art reference. In claim 18, both “too high” and “too low”, and in claim 20 “high-density”, are relative as they lack any metes and bound to define them.

In claim 24, line 4 introduces “a process gas”, but line 15 introduces the identical term without an article showing antecedent basis or clear differentiation , and likewise for “a plasma” in lines 6 and 18. In lines 15-16 “said gas mixing area” lacks proper antecedent basis.

In claim 25 “a stress level...” is not properly related to the previously introduced “<sup>4</sup> a predetermined intrinsic stress level “ of the independent claim.

In claim 26, which depends from claim 24, “said fluorine source” and ‘the total gas flow” lack proper antecedent basis.

(7) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed.

Art Unit: 1762

Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

(8) Claims 1-10 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 29-33, 38-40 and 42-45 of copending Application No. 08/888,499. Although the conflicting claims are not identical, they are not patentably distinct from each other because both sets of claims require the presence of halogen in Si oxide deposited from TEOS and source of F when using a plasma process of like frequencies. The claims differ in the order that limitations are required, 112 issues and the present application requires that at least 2.5 atomic % F be present in the deposit, while the other claims are unspecific but inclusive thereof. It would have been obvious for one of ordinary skill in the art to deposit sufficient halogen to produce desired effects when specifically taught to deposit the element, which would have been determined by routine experimentation and measurements.

In the appealed case, applicants appear to argue that in order to make a judicial double patenting rejection, the patent (this reissue application) must be prior art. This is incorrect. The requirements for making the rejection is satisfied by the cases being copending, which they were

Art Unit: 1762

with 08/888,499 having an effective filing date of 1/19/94 and the patent 5,571,571 having a filing date of 6/14/94 and the same grand parent 08/184,331 of which its parent is a CIP, as well as being again open to prosecution.

*This is a provisional obvious type double patenting rejection because the conflicting claims have not in fact been patented.*

(9) Claims 11-15 are rejected under 35 U.S.C. 102(b) or (e) as being anticipated by Homma (EPO 517,548A2 or US PN 5,288,578).

Homma teaches the formation of fluorine-containing silicon oxide films where the internal stress is  $2 \times 10^8$  dynes/cm<sup>2</sup> and the dielectric constant is about 3.7. Several methods of deposition are taught including plasma CVD via a parallel plate reactor and reaction gases of O<sub>2</sub>, TEOS and FSi (OCH<sub>2</sub>H<sub>5</sub>)<sub>3</sub>, called fluorotriethyloxysilane, but could also be called triethylfluorosilicate, so abbreviation could be FTEOS, FTES or TEFS. Homma uses flow controller, bubblers and nitrogen gas to introduce the reactant gases into the reaction chamber, hence the flow rates are selected and controlled, and for the conditions used, it is seen that the film properties produced are known, ie predetermined. See Figure 3 and col. 4, lines 8-57 in the EPO reference which is a statutory bar. The US Patent has like teachings, but is the (e) reference.

(10) Claims 16-17 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Homma (EPO or US(578)).

While Homma does not teach the production of negative stress values, they do indicate that for silicon oxide prior art (non-F deposit) stress value were higher citing  $1 \times 10^9$  dyn/cm and prior art dielectric constant were also higher, about 4.1 (col. 4, line 14 and 27). The addition of F

Art Unit: 1762

to the silicon oxide is taught to lower the stress by about an order of magnitude, which is consistent with applicant's teachings on col. 8, lines 20-25, but the apparent scientific errors of Figure 13, from which the values of claim 16 derive, make this claim impossible to more meaningfully treat, except to say that the values possibly intended if the graph made sense would probably correspond.

Concerning the dielectric constant, about 3.7 is not significantly different than about 3.8, especially considering variations in parameter, reactants and apparatus. (Also, one must consider that the higher end of the range, causes recapture which is not permissible in a reissue, as seen in Figure 11).

Homma's Figure 3 and its description, does not indicate that its controllers and plasma apparatus are coupled to a memory with computer readable medium and programming that contains instructions for running the flow controller and plasma apparatus, but it is a standard practice in the art to control such complex systems via computer containing such programming, hence it would have been obvious to one of ordinary skill in the art to use computer control for its conventional purpose in running plasma deposition processes, because of the known benefits of precision, and efficiency, speed, etc... provided by computer control.

It is further noted that the particular flow rates chosen for any specific results will depend on the chemical reactivity and elemental composition of the particular gas chosen in conjunction with other process parameters, hence applicant's flow rate in claim 26, besides being new matter and a process limitation in an apparatus claim, lacks any context that might make it meaningful.

Art Unit: 1762

(11) Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Homma (EPO or 518) alone or in view of Ikeda (899) or Nishiyama et al.

While Homma (EPO or 518) do not discuss the production of multiple coated substrates where the stress is measured for each deposit then adjustments in deposition parameters, such as the claimed flow are made, if the value of the stress is greater or less than desired, however as manufacturers generally desire consistent products, use of Homma's process in a production line would have been expected by one of ordinary skill and competence to have been controlled to maintain desired silicon oxide layer properties. As Homma teaches that addition of F reduces stress, it would have been obvious to one of ordinary skill in the art that the concentration of fluorine doped into the Si oxide would have effected the value of the stress level, because the general trend has already been shown, and it would have been a matter of routine experimentation to determine what [F] produces that stress. Since it is well known that the supply of a dopant precursor, ie its flow rate, effects its concentration in the doped product due to basic chemical principles, control of flow rate to maintain a desired stress value in a process deposition line would have been obvious to one of ordinary skill as a matter of competent workmanship.

Alternately, Ikeda (899) who teaches deposition of F-doped silicon oxide films from TEOS and TEFS (or other halogen compounds such as SiF<sub>4</sub> or SiCl<sub>4</sub>) using CVD or alternately plasma CVD (Abstract; Examples and col. 7, lines 44-55), specifically teaches that the quantity of F remaining in the deposited silicon oxide film is roughly proportioned to the flow rate of

Art Unit: 1762

TEFS gas (col. 6, lines 38-45), hence when using the Homma process in an assembly line, it would have been obvious to control or maintain the concentration of fluorine deposited, hence stress of the film via monitoring and control of the flow rate of the halogen source. Use of any known type of plasma CVD apparatus would have been expected to produce successful results.

Alternately, Nishiyama et al also teaches deposition of silicon oxide containing F, where plasma CVD, including dual frequency or high density plasma are used (summary, esp. col. 2, lines 30-60 and col. 3, lines 31-56 and 66-col. 4, line 6). Explicit teachings that [F] in the  $\text{SiO}_2$  film "can be easily controlled by controlling the flow rate of the source gas" (col. 3, lines 53-56), with example 1 (col. 5-7) teaching reactant gases of  $\text{TEOS} + \text{O}_2 + \text{NF}_3$  where  $\text{NF}_3$  flow rates of 50 sccm, 100 sccm, 150 sccm and 2005ccm produced atomic % of about 2,3,4 and 5 respectively (col. 6, lines 36-50). Col. 7, provided alternate F-source teachings of  $\text{CF}_4$ ,  $\text{C}_1\text{F}_3$ ,  $\text{SiF}_4$  and  $\text{FSi}(\text{OC}_2\text{H}_5)_3$ , and discussion of other reactant combinations also showing flow rate dependance for [F] deposited. As dopant concentration of fluorine in the silicon oxide deposit of Homma would have been expected to effect the stress level as discussed above, as well as the dielectric constant which Nishiyama also discusses, it would have been obvious to one of ordinary skill in the art that as flow rate of the F-source has been shown by Nishiyama et al to be related to the amount of fluorine deposited, that controlling and adjusting flow rate in order to maintain or produce desired film properties dependent on the [F], such as the dielectric constant or the stress would have been expected to be an effective and efficient way to produce consistent and desired results.

Art Unit: 1762

It would also have been obvious in view of Nishiyama et al to have used alternate plasma reactors than those provided by Homma, as Nishiyama et al shows that dual frequency and high density, including use of RF coils produce desirable silicon oxide film deposition (Figures 14-15 plus example 6; and Figures 17-19 plus example 7).

(12) Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nishiyama et al.

It was noted in the reasons for allowance that Nishiyama et al was differentiated over by the allowed claims in PN. 5,571,571 because of the use of different precursor materials, however a closer reading of Example 1 (discussed above in section II) showed that the TEOS + O<sub>2</sub> + NF<sub>3</sub> reactant gases were explicitly taught to have effective alternatives for the taught and claimed deposition, with CF<sub>4</sub>, a claimed fluorocarbon being specifically suggested as an alternative for NF<sub>3</sub>, and various atomic % ranging from 2-5% suggested to be deposited dependant on flow rate. The more general teaching on col. 2, lines 53-54 also suggest NF<sub>3</sub>, CF<sub>4</sub> and C<sub>2</sub> F<sub>6</sub> alternately as other F-sources, hence it would have been abundantly obvious to one of ordinary skill in the art to substitute the claimed fluorocarbon compounds for NF<sub>3</sub> in the Nishiyama teaching to produce films by processes as claimed. Also note in col. 6, lines 12-25 of example 1, A1 wiring, ie spaced conductive lines, were formed on the substrate prior to the claimed and taught deposition. Any useful line width would have been expected to be used.

Nishiyama et al's example 6 teaches dual frequency plasma deposition with frequencies as claimed, but a different set of reactant gases, FSi (0C<sub>2</sub>H5)<sub>3</sub>+O<sub>2</sub>) however in example 1 on col.

Art Unit: 1762

7, lines 22-34, these gases were explicitly taught as possible alternatives to the TEOS + NF<sub>3</sub> combination, hence are of ordinary skill in the art would have expected the alternative dual frequency plasma apparatus to be effective with any of the taught gas combinations, hence obvious to use therewith.

Note example 1, gives TEOS flow rates as 50sccm and NF<sub>3</sub> as 0-500 sccm, depending on layer and trial. As NF<sub>3</sub> has three F, 50 sccm to 0-500sccm gives 1:(0-30) ratio of Si:F which is inclusive of 14:1, although from Nishiyama et al's teaching one would expect greater amounts of F to produce larger atom % F in the deposit, while applicant Fig. 9 appears to be saying just the opposite, ie that as the ratio of Si to F increases that atomic % actually goes in the opposite direction, but it is questionable whether this was actually what was meant, since decreasing the fluorine source does not usually increase the amount of it deposited unless some other parameters is significantly changed. (see comment in section 4).

(12) Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Homma (EPO or 518) optionally in view of Ikeda or Nishiyama et al as applied to claims 11-20 and 24-26 above, and further in view of Homma et al (075).

This set of claims differ from the previously treated set of claims, above applied references and original specification by requiring the deposit of a layer having first and second predetermined stress levels. First it is noted that no where in the claims is it clearly necessitated that there by any actual (numeral, etc.) difference between the first and second stresses, nor their associated 1st and 2nd rates, hence the claims could actually be said to read on one continuous

Art Unit: 1762

layer deposition with no change in stress valves whatsoever. This statement may even be applied to claims 22-23 as there is no clear indication in the specification by what applicant intends by compressive and tensile stress, but they may be two different ways of describing the same property, hence not necessarily representing different values. It is further noted that the deposition of the second portion of the layer also need not include plasma deposition.

However, assuming that the intent of the claim is that the first and second rates and stress levels are different, applicant's attention is directed to the teachings of Homma et al (075), which teaches alternate deposition techniques for successive layers of silicon oxide. TEOS/0, CVD alternated with PECVD is taught (col. 3, lines 10-63), where in embodiment 3 use of fluoroalkoxysilane produces F-containing silicon oxide on semiconductor substrates with an alti layer wiring. (Fig. 4; col. 4, line 52-col. 5, lines 17 and 34-45). While Homma et al (075) does not discuss stress levels of their multiple layers, they use of alternate deposition techniques and layer with differing F-content, inherently produce different stress levels and require different flow rates of the F-source. It would have been further obvious to one of ordinary skill in the art that since the Homma (EPO or 518) reference discuss previously teach that either PEVCD or thermal process may deposit fluorine doped Si oxide with like properties, both the non F-doped (selected flow rate close or equal to zero) and F-containing films could be plasma deposited, just using different fluorine source flow rates, although given the claim language, Homma et al (075)'s examples of alternate plasma and non-plasma CVD are acceptable.

Art Unit: 1762

(13) Claims 11-20 and 24-26 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 29-33, 38-40 and 42-45 of copending Application No. 08/888,499 in view of Nishiyama et al.

This is a provisional obviousness-type double patenting rejection.

While these claims of the present reissue are broader of scope and do not contain the duel frequency alternative, Nishiyama as discussed above teaches it as an alternative to other plasma deposition processes with the same or analogous reactants and products, hence it is obvious as stated above.

(14) Claims 21-23 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 29-33, 38-40 and 42-45 of copending Application No. 08/888,499 in view of Nishiyama et al in view of Homma et al (095).

These claims are also broader of scope in their reactants in the other case, but also differs by requiring multiple depositions, which are further obvious in view of Homma et al (075) for reason stated in section 12 above.

This is a provisional obviousness-type double patenting rejection.

(15) Claims 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over the PCT reference WO 92/20833 to Weise.

Weise teaches the use of halogen etchants such as  $\text{CF}_4$ ,  $\text{C}_2\text{F}_6$ ,  $\text{SiF}_4$ , etc (p. 9 and 15) to reduce the defects and amount of hydrogen present as hydroxyl in silicon oxide films deposited by methods inclusive of PECVD (p. 10, 11, 12), using organo silicones such as TEOS (p. 9 and

Art Unit: 1762

13), where the intrinsic stress of the deposit is thereby reduced from what it otherwise would have been. This process is controlled by adjusting the ratios of the gases introduced (p. 10 an 15). As the etchant (halogen gas) is taught to directly effect the intrinsic stress, choice of reactant ratio as taught is equivalent to predetermining the stress level due to the inter relationship. While Weise does not discuss selecting the rate at which the etchant/halogen source is introduced, the parameters of flow rate and reactant ratio are inherently related, such that it would have been obvious to one of ordinary skill in the art that in order to control the ratio of reactant one must select, ie control their flow. Other minor differences are like those discussed above and obvious for like reasons. Note that further 103 rejection combinations analogous to ones applied above could be made, but would be redundant.

(16) Any inquiry concerning this communication should be directed to M. L. Padgett at telephone number (703) 308-2336 and Fax # (703) 305-5408 (official); 305-3599 (afterfinal official); and 305-6357 (unofficial).

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